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Effect of the granulometric composition of microspherical catalyst on the product yield for the dehydrogenation of iso-butane

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Abstract

The effect of the granulometric composition of microspherical KDI alumina-chromia catalysts on variation of the height and density of a fluidized bed was analyzed during pilot industrial testing at the OAO Nizhnekamskneftekhim iso-butane dehydrogenation plant. It was ascertained that one of the factors determining the acceleration of the cracking reactions was a rise in temperature to 600-610°C in the upper part of the reactor at the level of grid no. 10 due to the reduction of the upper boundary of the fluidized bed as a result of carryover from the reactor-regenerator system of catalyst particles smaller than 20 microns. The formation of a stable fluidized bed on the upper grid of the reactor depends on the content of 20-40 μm particles within the circulating catalyst. In order to compensate for the carryover of the catalyst, it is recommended that the mixture of catalysts accumulated in the first and second electrofilter fields be loaded into the system as well. This load consists of ~25 wt % of the fraction with particle sizes of 20-40 μm and is as good the initial KDI in terms of catalytic parameters, ensuring stabilization of the fluidized bed height at a level of 52%, lowering of the temperature at the tenth grid of the reactor to 568°C, reduction of the yield of cracking products to 4.0 wt %, a 3% increase in the average daily output of iso-butylene, and a 7% decrease in the consumption of iso-butane. Recovery of the irrevocable carryout of the catalyst from the system and the formation of a stable fluidized bed were achieved by alternating the additional loading of the catalysts from the first and second fields of the electrofilter and the initial KDI with optimized fraction composition at a 4 : 1 ratio. © Pleiades Publishing, Ltd., 2011.

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Keywords

Abrasion, Dehydrogenation, Fluidized bed, Microspherical alumina-chromia catalysts, Particle carryover, Reactor